Configuring Data Compression Services

BayRS Version 13.10
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Bay Networks *Where Information Flows.*™

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Preface

Data compression is a routing feature that eliminates redundancy in data streams, reducing the amouont of bandwidth needed to transport LAN protocols over a wide area. Bay Networks® routers and routing software support data compression over frame relay, X.25, and PPP (dial-up or leased lines). This guide describes what you do to start and customize data compression on a Bay Networks router.

This guide describes how to use Site Manager to configure data compression on a router.

If you are responsible for configuring data compression, you need to read this guide.

If you want to	Go to
Start compression.	Chapter 1
Learn about data compression services.	Chapter 2
Change default settings for compression parameters.	Chapter 3
Obtain information about Site Manager parameters (this is the same information you obtain using Site Manager online Help).	Appendix A

Before You Begin

Before using this guide, you must complete the following procedures. For a new router:

- Install the router (refer to the installation guide that came with your router).
- Connect the router to the network and create a configuration file (refer to *Quick-Starting Routers*, *Configuring BayStack Remote Access*, or *Connecting ASN Routers to a Network)*.

Make sure that you are running the latest version of Bay Networks BayRS™ and Site Manager software. For information about upgrading BayRS and Site Manager, see the upgrading guide for your version of BayRS.

Text Conventions

This guide uses the following text conventions:

angle brackets (< >)	Indicate that you choose the text to enter based on the description inside the brackets. Do not type the brackets when entering the command. Example: If the command syntax is: **ping <***ip_address***>**, you enter: **ping 192.32.10.12**
bold text	Indicates command names and options and text that you need to enter. Example: Enter **show ip** {**alerts** | **routes**}. Example: Use the **dinfo** command.
italic text	Indicates file and directory names, new terms, book titles, and variables in command syntax descriptions. Where a variable is two or more words, the words are connected by an underscore. Example: If the command syntax is: **show at <***valid_route***>** *valid_route* is one variable and you substitute one value for it.
`screen text`	Indicates system output, for example, prompts and system messages. Example: `Set Bay Networks Trap Monitor Filters`

separator (>)	Shows menu paths. Example: Protocols > IP identifies the IP option on the Protocols menu.
vertical line (|)	Separates choices for command keywords and arguments. Enter only one of the choices. Do not type the vertical line when entering the command. Example: If the command syntax is: **show ip** {**alerts** | **routes**}, you enter either: **show ip alerts** or **show ip routes**, but not both.

Acronyms

This guide uses the following acronyms:

ACK	acknowledgement
CCP	Compression Control Protocol
CPC	continuous packet compression
DDN	Defense Data Network
DLCI	data link connection identifier
DTR	data terminal ready
IETF	Internet Engineering Task Force
ILCCP	Individual Link Compression Control Protocol
ILI	intelligent link interface
ISDN	Integrated Services Digital Network
ISDN BRI	ISDN Basic Rate interface
ISDN PRI	ISDN Primary Rate Interface
LAPB	Link Access Procedure-Balanced
LCP	Link Control Protocol
MCE1	multichannel E1
MCT1	multichannel T1
MIB	management information base

NCP	Network Control protocol
PDN	Public Data Network
PPC	packet-by-packet compression
PPP	Point-to-Point Protocol
PVC	permanent virtual circuit
RFC	Request for Comments
VC	virtual circuit
WAN	wide area network
WCP	WAN Compression Protocol

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In the United States and Canada, you can dial 800-2LANWAN for assistance.

Chapter 1
Starting Compression

The quickest way to begin using data compression on your network is to enable it with the default configuration that Bay Networks software supplies. This chapter briefly introduces Bay Networks data compression and includes the procedures for configuring compression with the default configuration values.

This chapter contains the following information:

Topic	Page
Summary of Bay Networks Data Compression Features	1-2
Preparing a Configuration File for Data Compression	1-4
Configuring Software Compression	1-5
Configuring Hardware Compression	1-9
For More Information	1-12

Summary of Bay Networks Data Compression Features

You can configure both software- and hardware-based compression on a circuit or line basis. Features specific to software and hardware compression follow.

Software-Based Data Compression

Bay Networks offers two software compression protocols:

- WAN Compression Protocol (WCP) -- for Point-to-Point Protocol (PPP), frame relay, and X.25 links
- Hi/fn LZS -- for PPP links only

Note: The Hi/fn™ LZS® compression option is not included with your initial purchase of BayRS. Bay Networks Hi/fn LZS compression software incorporates LZS (licensed from Hi/fn) and therefore must be purchased separately. To run Hi/fn LZS compression on a PPP link between a Bay Networks router and a non-Bay Networks router, you must obtain a license for the Hi/fn LZS compression software, which is delivered on a separate CD.

These two protocols use different Lev-Zimpel algorithms to implement compression and provide different levels of interoperability between Bay Networks routers and routers made by other vendors.

If both ends of the connection are Bay Networks routers, use WCP as the compression protocol. If the connection is a PPP link and only one end of the connection is a Bay Networks router, use Hi/fn LZS.

Software-based data compression works over WAN links. Specifically, WCP works with PPP, frame relay, and X.25 links; Hi/fn LZS works only with PPP links. Both WCP and Hi/fn LZS work with PPP multilink. WCP also works with PPP multiline.

Software compression includes the following features:

- Support for all Bay Networks platforms: BayStack™ Access Node (AN®), Access Stack Node (ASN™), Advanced Remote Node™ (ARN™), Backbone Node (BN®), and System 5000™
- Compression for a Bay Networks Fast Routing Engine (FRE®) module at 4 x 128 KB/s compressed throughput, full duplex; or 512 KB/s aggregate compressed throughput

- Compression for a BayStack AN platform at 2 x 64 KB/s compressed throughput, full duplex; or 128 KB/s aggregate compressed throughput
- Compression on all intelligent link interface (ILI) modules that support serial and ISDN BRI ports
- Compression on MCT1 and MCE1 lines

Hardware-Based Data Compression for the BN Platform

The FRE-2-060E processor module with advanced compression coprocessor daughterboard, available with BayRS Version 12.20 for the BN router platform, extends hardware-based data compression services to the link modules listed in Table 1-1.

Table 1-1. Link Modules Supported by FRE-2-060E Processor with Advanced Compression Coprocessor Daughterboard

Link Modules	Bay Networks Part Number
Octal Sync	5008
Oct Sync, HWComp32	AG2104037
Oct Sync, HWComp128	AG2104038
Dual Port Multi Channel T1	5945
Single Port Multi Channel T1	5944
Dual Port Multi Channel E1	77007
Single Port Multi Channel E1	77009
75 ohm Dual Port MCE1-II	AG2111004
75 ohm Single Port MCE1-II	AG2111003
120 ohm Dual Port MCE1-II	AG2111002
120 ohm Single Port MCE1-II	AG2111001
DB15 Quad MCT1	AG2111007
Ethernet Sync Advanced Filter	5431

The type of data compression you configure depends on the upper layer protocol you want to run over the link, as follows:

- To run frame relay, use WCP.
- To run PPP, use WCP if you are connecting Bay Networks routers. Use Hi/fn LZS if you are connecting routers of different vendors.

Previous Hardware-Based Data Compression

You can continue to use hardware-based data compression services provided by releases earlier than BayRS Version 12.20, which were based on:

- Optional daughterboards for PPP and frame relay networks that use the octal synchronous link module for the BN, using FRE-2 processors only.

Note: If a FRE-2-060E is present in the same slot as an octal synchronous hardware compression daughterboard, the FRE-2-060E will be used instead of the octal synchronous daughterboard.

- Optional net modules for PPP and frame relay networks that use the ASN. Hardware compression can compress data transmitted over WANs attached to the following net modules: dual and quad synchronous, MCE1/ISDN PRI, MCT1/ISDN, dual synchronous with ISDN BRI, and Quad BRI.

Preparing a Configuration File for Data Compression

To configure data compression, use the Bay Networks Site Manager configuration tool. For information about working with configuration files, see *Configuring and Managing Routers with Site Manager, as appropriate*.

Before starting data compression, you must create and save a configuration file with at least one unconfigured WAN interface, such as a synchronous or MCT1 port.

Configuring Software Compression

Software compression works on all router platforms and all serial interfaces. After you open a configuration file, you can enable compression using Site Manager.

To use Site Manager to configure this interface for compression for PPP, frame relay, or X.25, first complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the main Site Manager window, choose **Tools.**	The Tools menu opens.
2. Choose **Configuration Manager**.	The Configuration Manager menu opens.
3. Choose **Local File**, **Remote File**, **Dynamic**, or **Cache**.	Site Manager prompts you for the configuration file you want to open.
4. Select the file.	The Configuration Manager window opens, displaying the router modules.

From the Configuration Manager window, proceed to the following sections to configure a WAN protocol and compression.

- Enabling Compression for PPP on page 1-6
- Enabling Compression for Frame Relay on page 1-6
- Enabling Compression for X.25 on page 1-8

Enabling Compression for PPP

To configure software compression on a PPP interface, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, click on the link or net module connector for which you are enabling data compression.	The Add Circuit window opens.
2. Accept the default circuit name or rename the circuit, then click on **OK**.	The WAN Protocols window opens.
3. Choose **PPP** as the WAN protocol.	Site Manager enables the protocol.
4. Click on **OK**.	The Select Protocols window opens.
5. Enable data compression for PPP by choosing one of the following: • Choose **WCP** if connecting to another Bay Networks router. • Otherwise, choose **Hi/fn LZS**.	Site Manager enables compression on this interface.
6. Click on **OK**.	You return to the Configuration Manager window.

Enabling Compression for Frame Relay

To configure software compression on a frame relay interface, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, click on the link or net module connector for which you are enabling data compression.	The Add Circuit window opens.
2. Accept the default circuit name or rename the circuit, then click on **OK**.	The WAN Protocols window opens.
3. Choose **Frame Relay** as the WAN protocol.	Site Manager enables the protocol.

Site Manager Procedure *(continued)*	
You do this	**System responds**
4. Click on **OK**.	The Select Protocols window opens.
5. Enable data compression for frame relay by choosing **WCP**.	Site Manager enables compression on this interface.
6. Click on **OK**.	You return to the Configuration Manager window.

Enabling Compression for X.25

To enable WCP on an X.25 interface, you must first add an X.25 service record, then enable compression for the X.25 interface. See *Configuring X.25 Services* for information about X.25 service records.

To enable compression on an X.25 interface, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, click on the link or net module connector for which you are enabling data compression.	The Add Circuit window opens.
2. Accept the default circuit name or rename the circuit, then click on **OK**.	The WAN Protocols window opens.
3. Choose **X.25** and click on **OK**.	The X.25 Packet Configuration window opens.
4. Enter the required information, then click on **OK**.*	The X.25 Service Configuration window opens.
5. Click on **Add**.	The X.25 Service Record window opens.
6. Enter the required information then click on **OK**.*****	You return to the X.25 Service Configuration window.
7. Choose **Protocols**.	The Protocols menu opens.
8. Choose **Add/Delete**.	The Select Protocols window opens.
9. Choose **WCP**.	Site Manager enables compression on this interface and then returns you to the X.25 Service Configuration window.†
10. Set the **Enable Compression** parameter to **Enable**. Do this for each X.25 interface that you configure.	Site Manager enables compression for this interface.
11. Click on **Done**.	You return to the Configuration Manager window.

* Site Manager requires that you configure certain packet and service parameters. See *Configuring X.25 Services* for information about these parameters.

† At the time you enable compression, you can also enable other protocols.

Configuring Hardware Compression

To use hardware compression for the BN router, you must have either an octal synchronous link module with a hardware compression daughterboard or the FRE-2-060E processor module with advanced compression coprocessor daughterboard. For the ASN router, you must have a hardware compression net module.

You can use hardware compression with PPP and frame relay.

Configuring Compression for a BN (FRE-2-060E Processor)

To configure hardware compression for a BN that has a FRE-2-060E processor module with advanced compression coprocessor daughterboard, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, click on the slot in which the FRE-2-060E processor module with advanced compression coprocessor is installed and choose the link module for which you want to enable data compression.	Site Manager selects the module.
2. Click on **OK**.	You return to the Configuration Manager window. The link module is added to the slot.
3. Choose a port.	The Add Circuit window opens.
4. Accept the default circuit name or enter a new name, then click on **OK**.	The WAN Protocols window opens.
5. Choose one of these WAN protocols: • **PPP** • **Frame Relay**	Site Manager selects the protocol.
6. Click on **OK**.	The Select Protocols window opens.

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
7. Enable data compression as follows: • For frame relay, choose **WCP**. • For PPP, choose **WCP** if connecting to another Bay Networks router. Otherwise, choose **Hi/fn LZS**.	Site Manager enables compression on this interface.
8. Click on **OK**.	You return to the Configuration Manager window.

Configuring Compression for a BN (Octal Synchronous Link Module)

To configure hardware compression for a BN that has an octal synchronous link module with a hardware compression daughterboard, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, click on an empty slot and choose one of the following octal synchronous link modules with a hardware compression daughterboard: • **AG2104037** • **AG2104038***	Site Manager selects the module.
2. Click on **OK**.	You return to the Configuration Manager window. The link module is added to the slot.
3. Choose a port.	The Add Circuit window opens.
4. Accept the default circuit name or enter a new name, then click on **OK**.	The WAN Protocols window opens.
5. Choose one of these WAN protocols: • **PPP** • **Frame Relay**	Site Manager selects the protocol.
6. Click on **OK**.	The Select Protocols window opens.

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
7. Choose **WCP**.	Site Manager enables compression on this interface.
8. Click on **OK**.	You return to the Configuration Manager window.

* If you have a hardware compression link module on a BN, you can use hardware compression on any WAN port on a slot. Hardware compression on the BN does not work across slots.

Configuring Compression for an ASN

To configure hardware compression for the ASN, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, click on an empty slot and choose one of the following net modules for hardware compression: • **AF2104007** • **AF2104012***	Site Manager selects the net module.
2. Click on **OK**.	You return to the Configuration Manager window. The net module is added to the slot.
3. Click on the slot that contains the hardware compression module and choose a WAN net module.	Site Manager selects the WAN net module.
4. Click on **OK**.	You return to the Configuration Manager window. The WAN net module is placed over the compression module.
5. Choose a port.	The Add Circuit window opens.
6. Accept the default circuit name or enter a new name, then click on **OK**.	The WAN Protocols window opens.
7. Choose one of these WAN protocols: • **PPP** • **Frame Relay**	Site Manager selects the protocol.

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
8. Click on **OK**.	The Select Protocols window opens.
9. Choose **WCP**.	Site Manager enables compression on this interface.
10. Click on **OK**.	You return to the Configuration Manager window.

* If you have a hardware compression net module on an ASN, you can use hardware compression on any WAN port on that single router or slot. Hardware compression on the ASN does not work across slots; that is, it does not provide compression for any other ASNs in the stack.

For More Information

For detailed information about Bay Networks data compression, see Chapter 2, "Data Compression Overview."

For information and recommendations about using nondefault values to customize compression, see Chapter 3, "Customizing Data Compression."

Chapter 2
Data Compression Overview

Bay Networks data compression services enable you to reduce line costs and improve response times over wide area networks. In addition, they eliminate redundancies in data streams. When you use compression on a network, bandwidth efficiency improves so you can transmit more data.

This chapter contains the following information:

Topic	Page
Bay Networks Compression Services	2-2
Data Compression Architecture	2-3
Data Compression Performance	2-5
Hardware Compression	2-5
How Data Compression Works	2-8
Compression Features for Specific Protocols	2-11

Bay Networks Compression Services

Bay Networks compression services include:

- Software-based compression for PPP, frame relay, and X.25 networks for all router platforms and all serial interfaces.

  PPP compression works on multiline, multilink, on the ISDN BRI and PRI modules, and on lines that use Raise DTR or V.25bis modem interfaces with dial services. Frame relay compression works on multiline and dial backup lines.

- Hardware-based compression for PPP and frame relay networks for BN routers using one of the following modules:

  -- Octal synchronous link module using FRE-2 processors

  -- FRE-2-060E processor module with the advanced compression coprocessor daughterboard to which you can connect a broad range of Bay Networks link modules (see "Hardware-Based Data Compression for the BN Platform" on page 1-3 for the list of supported link modules).

  Hardware compression on the BN supports all PPP and frame relay services that WCP software compression supports.

- Hardware-based compression for PPP and frame relay networks for the ASN router.

  A compression net module compresses data transmitted over a WAN network by dual and quad synchronous, MCE1/ISDN PRI, MCT1/ISDN, dual synchronous with ISDN BRI, and Quad BRI net modules. Hardware compression on the ASN supports all PPP services that WCP software compression supports.

Bay Networks WCP software- and hardware-based compression interoperate fully because they use the same algorithm.

Hi/fn LZS hardware compression is supported by the FRE-2-060E processor with the advanced compression coprocessor daughterboard for the BN when connecting to a router from another vendor that is also running the Hi/fn LZS algorithm.

To use software data compression effectively, you must decide how to allocate memory for this task. The goal is to compress data as much as possible and to transmit the data as quickly as possible without taxing the resources of the router.

Data Compression Architecture

WCP and Hi/fn LZS use different compression algorithms and protocols. The compression protocol that you choose depends on whether you are communicating with routers from Bay Networks or other vendors.

Table 2-1 lists the algorithms and protocols that Bay Networks uses to provide data compression services for WCP and Hi/fn LZS.

Table 2-1. Data Compression Algorithms and Protocols

WCP	Hi/fn LZS
LZ-77 algorithm	Hi/fn LZS algorithm
Compression Control Protocol (RFC 1962)	Compression Control Protocol (RFC 1962)
Bay Networks proprietary WAN Compression Protocol (WCP)	References the PPP Hi/fn LZS Compression Protocol (RFC 1974) as a guideline

You must ensure that routers at both ends of the connection are using the same compression protocol.

- If both ends of the connection are Bay Networks routers, configure both routers to use WCP as the compression protocol.
- If the connection is a PPP link and only one end of the connection is a Bay Networks router, configure both routers to use Hi/fn LZS.

If you want the router to negotiate which protocol is used, set the Compression Protocol parameter to Any (see page A-15 for the parameter description).

LZ-77 Algorithm

Bay Networks WCP data compression software is based on a Lempel-Ziv (LZ-77) algorithm. The algorithm uses a sliding history buffer that stores the data that the network link has processed most recently. The compressor compares new data strings with data it has already processed and stored in the buffer. When the compressor detects data strings that match data it has already processed, it replaces those strings with offset and length tokens that are shorter than the original strings, thus compressing the data.

Hi/fn LZS Algorithm

Hi/fn is a wholly owned subsidiary of Stac, Inc. Bay Networks Hi/fn LZS compression software incorporates LZS from Hi/fn.

Bay Networks Hi/fn LZS compression software is based on the Hi/fn LZS algorithm to transport compressed packets across a PPP link. Hi/fn LZS implements an error detection mechanism, which means that it can detect whether packets are lost during transmission. Hi/fn LZS does not retransmit packets if they are lost.

The Hi/fn LZS compression algorithm searches incoming data for redundant data strings and replaces these strings in the outgoing data with encoded tokens of shorter length. Hi/fn LZS creates the encoded tokens from information in a table that the Hi/fn LZS algorithm builds. This table consists of string matches, which point to previous incoming data. As the table is built and tokens are created, subsequent data is compressed based on previous data.

Compression Control Protocol (CCP)

Bay Networks uses RFC 1962, the Compression Control Protocol (CCP), to enable or disable compression across a PPP link and determine what kind of compression is used. CCP also includes a history reset request and acknowledgment capability, which Hi/fn LZS uses but WCP does not. WCP uses its own negotiation mechanism.

Bay Networks WAN Compression Protocol (WCP)

Bay Networks proprietary WAN Compression Protocol (WCP) is an IETF draft standard. WCP enables compression for frame relay and for X.25, and transports compressed packets for PPP, frame relay, and X.25. WCP negotiates compression mode, history size, and buffer size. For PPP and frame relay, WCP also retransmits packets in the event of packet loss and protects against inadvertent data expansion (LAPB retransmits packets for X.25).

WCP is most effective for sites that have WAN connections operating at relatively low speeds such as 56/64 KB, where you want to achieve data compression at low cost and with minimal memory requirements. WCP supports connections up to 512 KB/s on the FRE-040. For networks operating at faster speeds, you should use hardware compression.

PPP Hi/fn LZS Compression Protocol

PPP uses CCP to negotiate how the router uses the Hi/fn LZS Compression Protocol (RFC 1974). Specifically, CCP negotiates the different compression modes that RFC 1974 supports. Bay Networks negotiates only mode 3 and the number of compression histories, of which we support only one history.

RFC 1974 is specified only as an error detection protocol; unlike WCP, it does not contain a transmit history. Instead, it relies on upper layer protocols to retransmit data when errors occur.

For more information about compression protocol modes, refer to RFC 1974.

Data Compression Performance

The goals in using data compression are to achieve a high compression ratio while maximizing throughput. *Compression ratio* is the size of uncompressed data compared to the size of the same data after it is compressed. *Throughput* refers to the amount of data that goes across the network in a specific amount of time. The amount of throughput can indicate the efficiency and speed of the network.

The compression ratio varies according to the effectiveness of the compression algorithm, but also according to the characteristics of the data you are transmitting. Data that includes many redundant strings compresses at a high ratio.

Throughput varies according to the number of devices in the network through which the data must travel. Throughput is also affected by the compression and decompression process.

Hardware Compression

Bay Networks hardware-based compression works with frame relay and PPP networks. It best serves sites that support T1 or E1 lines, which often concentrate many lower-speed remote connections. The hardware compression facility operates at high speeds and also supports high-density WAN connections. Use hardware compression when you want to achieve high compression ratios and throughput, and also want to conserve router memory for other functions.

Hardware Compression for the BN

The BN supports the following compression daughterboards:

- AG2104037 - Octal Sync with a 32-contexts hardware compression daughterboard
- AG2104038 - Octal Sync with a 128-contexts hardware compression daughterboard
- Advanced compression coprocessor daughterboard with 128 or 256 contexts installed on the FRE-2-060E processor module

Hardware Compression for the ASN

The hardware compression net modules for the ASN can compress data transmitted over WAN networks attached to dual and quad synchronous, MCE1/ISDN PRI, MCT1/ISDN, dual synchronous with ISDN BRI, and Quad BRI net modules. One compression net module in a single ASN can provide hardware compression for all the net modules on that router. It does not provide compression for any other ASN in the stack.

The compression net module is available in both a 32-contexts and a 128-contexts version.

The ASN supports the following compression net modules:

- AF2104007 - 32-contexts hardware compression net module
- AF2104012 - 128-contexts hardware compression net module

Hardware Compression Contexts for WCP

A *context* refers to compression and decompression for a single virtual circuit (VC). Compression hardware maps a context to specific regions of compression and decompression memory.

- A 32-contexts compression daughterboard or net module can run compression simultaneously over 31 continuous packet compression (CPC) contexts, each using an 8 KB history size, with one shared 8 KB packet-by-packet compression (PPC) context.

- A 128-contexts compression daughterboard or net module can run compression simultaneously over 127 CPC contexts, each using an 8 KB history size, with one shared 8 KB PPC context.
- A 256-contexts advanced compression coprocessor daughterboard installed on a FRE-2-060E processor module can run compression simultaneously over 255 CPC contexts, each using an 8 KB history size, with one shared 8 KB PPC context.

The 32-contexts, 128-contexts, and 256-contexts daughterboards and net modules differ in their amount of memory.

- The 32-contexts daughterboard and net module have 512 KB compression/256 KB decompression.
- The 128-contexts daughterboards and net module have 2 MB compression/1 MB decompression.
- The 256-contexts advanced compression coprocessor daughterboard has 4 MB compression/2 MB decompression.

Note: You should plan your network to use hardware compression on the VCs most important to you within the limits of your equipment. If you configure more VCs for hardware compression than your daughterboard or net module can support, you cannot control which VCs will use hardware compression. By default, all VCs that exceed the hardware context limit use software compression.

For information about customizing CPC and PPC, see Chapter 3, "Customizing Data Compression."

Hardware Compression Contexts for Hi/fn LZS

Hi/fn LZS supports a 2 KB history size and CPC contexts only. Hi/fn LZS does not support PPC contexts.

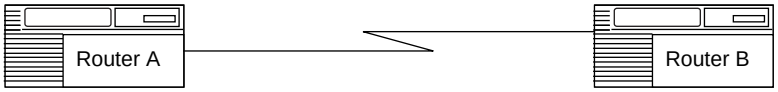
How Data Compression Works

To transmit compressed data, the router must complete one or both of the following:

- CCP negotiations (for PPP connections using WCP or Hi/fn LZS)
- WCP negotiations (for PPP, frame relay, and X.25 connections using WCP)

The following sections describe how these negotiations work. As you read these sections, see Figure 2-1, which illustrates CCP and WCP initialization on a PPP link.

If compression is across a frame relay or X.25 link, the router negotiates only WCP; CCP does not apply.



1. PPP interface on network; LCP negotiations complete; begin CCP negotiations:

Send initialization-request →
← Send initialization-request
Send initialization-ACK →
← Send initialization-ACK

2. CCP negotiations complete; begin WCP negotiations, including compression mode, history size, and buffer size:

Send initialization-request →
← Send initialization-request
Send initialization-ACK →
← Send initialization-ACK

3. WCP negotiations complete; begin NCP negotiations:

Send configure-request →
← Send configure-request
Send configure-ACK →
← Send configure-ACK

4. NCP open; begin transmitting data:

← Send data →

DC0001A

Figure 2-1. CCP and WCP Initialization on a PPP Link

CCP Negotiations

CCP allows the two ends of a PPP connection to negotiate whether to use data compression and, if so, which algorithm to use. Both WCP and Hi/fn LZS use CCP to negotiate compression.

Note: If one side of a link requests an algorithm that the other side does not support, traffic over the link continues, but in uncompressed form.

In Figure 2-1, negotiations begin when PPP establishes a link. CCP uses the same configuration and network control protocol negotiations that the Link Control Protocol (LCP) uses to establish a link.

For Hi/fn LZS, CCP also provides the following:

- History reset request messages
- Request acknowledgment messages

These messages help to synchronize the receipt and transmission of the compression and decompression history after a packet is lost. WCP does not use these messages.

For an explanation of LCP negotiations, see *Configuring PPP Services.*

WCP Negotiations

WCP allows two ends of a PPP, frame relay, or X.25 connection to negotiate compression.

Frame relay and X.25 use WCP to negotiate whether to use data compression and which algorithm to use. (PPP uses CCP and WCP to negotiate this information.) As with PPP, if one side of a link requests an algorithm that the other side does not support, traffic continues, but in uncompressed form. All three WAN protocols use WCP to negotiate options such as compression mode, history size, and buffer size.

Each side of a link running data compression has a compressor, a decompressor, a compression history, and a retransmission buffer. You can edit WCP parameters for compression mode, history size, and buffer size to optimize compression performance on your network (see “Allocating Compression Memory for WCP” on page 3-2).

Data Transmission

For PPP links using WCP, Network Control Protocol (NCP) negotiations and WCP negotiations occur simultaneously. When PPP, NCP, and WCP negotiations are complete, data transmission using compression begins.

For PPP links using Hi/fn LZS, data transmission using compression begins when CCP and NCP negotiations are complete.

For frame relay and X.25 links, data transmission using compression begins when WCP negotiations are complete.

Compression Features for Specific Protocols

Bay Networks data compression services vary in some details according to the WAN protocols that you configure. Read the following sections to learn about how Bay Networks implements data compression for PPP, frame relay, and X.25 services.

PPP Services

You can use software or hardware data compression on all PPP circuits, including multiline and multilink, bandwidth-on-demand, dial-on-demand, and dial backup lines. When you use compression on a bandwidth-on-demand, dial-on-demand, or dial backup circuit, WCP automatically configures or deletes compression as lines are added to or removed from the circuit.

PPP Multiline

Multiline enables you to configure a single circuit consisting of one or more WAN data paths. A *data path* is a logical point-to-point channel; it can be a permanent or dial-up physical line, or it can be a virtual circuit connection. Multiline provides both increased fault tolerance and greater bandwidth between two sites.

For more information about Bay Networks multiline, see *Configuring WAN Line Services*.

PPP Multilink

Multilink provides capabilities beyond those of multiline circuits. Multilink consists of a *bundle* of lines between two peers, consisting of up to four links. Multilink allows you to:

- Distribute traffic across the lines in the bundle in amounts roughly proportional to the effective bandwidth of each link.
- Use lines that have different speeds, proportionally distributing traffic over those lines.
- Balance traffic load and restore packet sequence.
- Use switched lines (such as ISDN B channels) as well as leased lines.
- Monitor traffic volume.

Depending on the version of BayRS, the router handles the operation of PPP multilink and WCP differently.

For BayRS Version 12.10 and later, by default the router negotiates WCP above the PPP multilink bundle for new circuits only. Negotiating compression *above the bundle* means that data packets are first compressed and then distributed across the links in the bundle. The distribution of traffic occurs once for the entire bundle, so the balance of traffic across the bundle is more accurate. In addition, the router uses less memory for compression.

Routers using BayRS Version 12.10 or later with an older configuration file negotiate WCP below the multilink bundle by default. Negotiating compression *below the bundle* means that data packets are first distributed across the links and then compressed. Compression is done individually for every link. You can reconfigure the circuit to negotiate WCP above the bundle by changing the CCP Type parameter to CCP on the routers at both ends of the link.

If you configure a new multilink circuit on a local router running BayRS Version 12.10 or later, and the remote router is running a version earlier than 12.10, you must change the CCP Type parameter from the default (CCP) to ILCCP for the local router and set the PPP Mode to multilink.

For a description of the CCP Type parameter, see page A-14.

PPP Bandwidth-on-Demand

Bandwidth-on-demand allows a secondary dial-up line to augment a primary leased line when the primary line experiences congestion. Congestion occurs when traffic volume exceeds line capacity. When congestion abates, the secondary line becomes inactive.

If you configure bandwidth-on-demand and WCP, it affects the bandwidth-on-demand congestion thresholds. These thresholds instruct the router to activate additional links from a multilink bundle to relieve congestion.

For BayRS Version 12.10 and later, when WCP is negotiated above the multilink bundle and the router sends or receives data, it calculates the congestion thresholds based on compressed data. If WCP is negotiated below the bundle, the router calculates these thresholds based on uncompressed data.

If a router using BayRS Version 12.10 or later is communicating with a router using software earlier than Version 12.10, the routers must negotiate WCP below the bundle, so the thresholds will be based on uncompressed data.

To configure these thresholds, see *Configuring Dial Services*.

PPP Dial-on-Demand

Dial-on-demand service enables you to establish a circuit only when you want to transmit and receive data, as opposed to having a leased line, which is always available. By using a circuit on a demand basis, you can significantly reduce your line costs.

PPP Dial Backup

PPP also allows you to configure *dial backup* service. If a primary PPP line fails and you enabled dial backup, the router automatically establishes a backup line. You cannot enable any protocols, including compression, on a backup circuit, because a backup circuit inherits its protocols from the primary circuit. If the primary circuit uses compression, then the backup circuit does also.

For more information about Bay Networks dial services, see *Configuring Dial Services*.

Frame Relay Services

You can use software (WCP only) or hardware data compression with frame relay. You can use compression with some virtual circuits (VCs), and not with others, as you choose, both for regular frame relay VCs, and for those you configure in hybrid mode. You can also use compression with dial-on-demand and dial backup services.

You must enable compression on both sides of a frame relay link. If you enable data compression on only one side of the link, data transmission occurs, but in uncompressed form.

Frame Relay Hybrid Access

Hybrid access enables you to combine bridging and routing over a single frame relay interface.

When you enable data compression for frame relay on a hybrid circuit, both the bridged and the routed traffic over that circuit are compressed. Note that compression applies only to the hybrid permanent virtual circuit (PVC), and not to the other PVCs from the main circuit, unless you also enabled compression for those interfaces. Conversely, if you enable data compression for other PVCs, but not on a PVC you configured for hybrid mode, the hybrid circuit does not use compression.

Frame Relay Dial-on-Demand

Frame relay enables you to configure dial-on-demand service. *Dial-on-demand* enables the router to activate a dial-up line only when there is data to send or when you configure the router to force the activation of a dial-up line. Using frame relay dial-on-demand ensures that you establish connections only when you need them, as opposed to using leased lines, which are active regardless of data activity. This helps you reduce line costs.

Frame Relay Dial Backup

Frame relay enables you to configure *dial backup* service. If a primary frame relay circuit fails and you enable dial backup, the router automatically establishes a backup circuit. The backup circuit can be a PPP circuit, a frame relay circuit that uses direct mode (a service record with only one PVC), or a frame relay circuit that uses group mode (a service record with two or more PVCs).

The backup circuit can inherit the primary circuit's configuration, or it can use its own. When the frame relay primary and backup use the same configuration, they have a *shared* configuration. The backup circuit uses the same network layer address as the primary circuit. The data link layer configuration, that is, the backup PVCs, data link connection identifiers (DLCIs), and filters, can be the same or different from the primary.

If the backup uses a unique configuration, it is a *secondary* configuration. A secondary configuration uses a different network layer address, PVCs, and filters from the primary.

To use data compression with frame relay dial backup, you must configure compression on both the primary and the backup circuit. The backup circuit does not necessarily inherit the PVC configuration from the primary circuit, because the backup PVCs can have different configurations from the primary.

For more information about Bay Networks dial services, see *Configuring Dial Services*.

X.25 Services

An X.25 network permits as many as 128 VCs to exist on the same physical link at the same time. You can configure each of these interfaces individually to use data compression or not.

X.25 PDN and DDN Services

When you use data compression on circuits that you configure for X.25 Public Data Network (PDN) or Defense Department Network (DDN) services, you must enable compression on both sides of the link. If you configure compression on only one side of a PDN or DDN link, the data that travels over that link will be corrupted.

You must also remember to enable the X.25 service record compression parameter for each X.25 interface that you configure. For more information about this parameter, see *Configuring X.25 Services.*

Adjusting X.25 Max Window Size

Window size can affect packet throughput across the X.25 network. Setting the X.25 Max Window Size parameter too low can cause the router to drop packets and render data compression ineffective. You should configure this parameter at a higher value than the default setting.

Chapter 3
Customizing Data Compression

When you enable data compression, default values are in effect for all parameters. This chapter provides information about customizing Bay Networks compression to use it most effectively on your network.

This chapter contains the following information:

Topic	Page
Allocating Compression Memory for WCP	3-2
Customizing Hardware Compression	3-9
Changing the Compression Control Protocol	3-13
Disabling and Reenabling Compression	3-14
Deleting Data Compression from a Router	3-16

Allocating Compression Memory for WCP

Using WCP across a network involves allocating memory to maximize compression without taxing the resources of your router. To achieve this goal, you can customize compression parameters to:

- Maximize the compression ratio.
- Maximize throughput.
- Prevent data loss.

Maximizing the Compression Ratio

You can compress data in one of two modes:

- *Continuous packet compression (CPC)* maintains compression history across packets. CPC yields a higher compression ratio than packet-by-packet compression. In most circumstances, you should select CPC, the default value, to maximize compression.
- *Packet-by-packet compression (PPC)* creates a new history for each packet. PPC yields a lower compression ratio than CPC. Select PPC only for links that drop a very large number of packets. Be aware that under these circumstances, implementing data compression may offer little or no advantage.

  If either side of the link specifies PPC, both sides of the link must use PPC.

To specify the compression mode for a line, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Lines**.	The WCP Line Interfaces List window opens.
4. Select a line from the list.	

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
5. Set the **Compression Mode** parameter. Click on **Help** or see the parameter description on page A-4.	
6. Click on **Done**.	You return to the Configuration Manager window.

To specify the compression mode for a circuit, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Interfaces**.	The WCP Circuit Interfaces List window opens.
4. Select a circuit from the list.	
5. Set the **Compression Mode** parameter. Click on **Help** or see the parameter description on page A-9.	
6. Click on **Done**.	You return to the Configuration Manager window.

Maximizing Throughput

Each side of the link has both a compression and decompression history and a lookup table. The compression and decompression histories maintain a record of data that has already traveled across the network. The lookup tables maintain pointers to redundant strings and the offset and length tokens that replace each of those strings.

You can specify either 8 KB or 32 KB of local memory to maintain a compression history. When you make this choice, be aware that you are allocating more memory than the History Size parameter value indicates.

Table 3-1 lists the amount of memory required for 8 KB and 32 KB history sizes.

Table 3-1. Memory Allocation for Software Compression History

Memory Requirements	8 KB History Size	32 KB History Size
Compression history	8 KB	32 KB
Lookup table	16 KB	64 KB
Decompression history	8 KB	32 KB
Total memory required	32 KB	128 KB

If you select different values for history size for the two sides of the link, 8 KB becomes the history size for both sides of the link.

Hardware compression has similar requirements (see "History Size with Hardware Compression" on page 3-4).

8 KB History Size

In general, 8 KB histories are appropriate for frame relay and X.25, when you have large numbers of VCs and need to conserve memory for each of them.

32 KB History Size

For PPP, with only one circuit per line, you may want to use a 32 KB history. You may also want to allocate a 32 KB history size for links with speeds higher than 64 Kb/s to improve throughput. The compressor can find a data pattern match up to three times faster using a 32 KB history than an 8 KB history.

History Size with Hardware Compression

Hardware compression daughterboards and net modules are available in 32, 128, and 256 contexts. The numbers 32, 128, and 256 assume a history size of 8 KB per context, although you can set the history size to either 8 KB or 32 KB. For example, if you set the history size to 32 KB, you use four 8 KB contexts, and you have that many fewer contexts available to run hardware compression on your network.

Note: Although software compression does not place strict limits on the number of contexts you can configure, memory requirements for history size are the same for both software and hardware compression.

Compression daughterboards reserve one 8 KB context for PPC, as opposed to CPC. There is no limit to the number of VCs that can use this one PPC context. The maximum number of VCs for the compression engine is 256.

The compression hardware uses memory in units called *pages*, where a page equals 32 KB of memory. Each context that uses a 32 KB history uses one page of memory. Restrictions for CPC contexts using either 8 KB or 32 KB histories are that the memory used for any one history must be continuous, and that it may not cross pages. For 8 KB contexts, these restrictions create few constraints, but for 32 KB contexts, they are significant.

Table 3-2 shows the maximum number of 8 KB contexts each daughterboard or net module can support.

Table 3-2. Hardware Compression: 8 KB Contexts

Daughterboard or Net Module	Maximum 8 KB CPC Contexts	Available 32 KB CPC Contexts	Reserved 8 KB PPC Contexts
32-context	31	0	1
128-context	127	0	1
256-context (advanced compression coprocessor daughterboard)	255	0	1

Table 3-3 shows the maximum number of 32 KB contexts each daughterboard or net module can support.

Table 3-3. Hardware Compression: 32 KB Contexts

Daughterboard or Net Module	Maximum 32 KB CPC Contexts	Available 8 KB CPC Contexts	Reserved 8 KB PPC Contexts
32-context	7	3	1
128-context	31	3	1
256-context (advanced compression coprocessor daughterboard)	63	3	1

You can combine 8 KB and 32 KB contexts on one daughterboard or net module. However, if you bring VCs up and down, memory may fragment. Even when you have 32 KB or more of compression memory available, if it is on different pages you will not be able to configure a 32 KB context. To solve this problem, save your configuration and reset the slot. When you reset the slot, available compression memory is rearranged to be contiguous.

If you have available memory, you can always add an 8 KB context, because 8 KB is the smallest divisible amount of compression memory.

Modifying the History Size

To modify the history size for a line, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Lines**.	The WCP Line Interfaces List window opens.
4. Select a line from the list.	
5. Set the **History Size** parameter. Click on **Help** or see the parameter description on page A-5.	
6. Click on **Done**.	You return to the Configuration Manager window.

To modify the history size for a circuit, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Interfaces**.	The WCP Circuit Interfaces List window opens.
4. Select a circuit from the list.	
5. Set the **History Size** parameter. Click on **Help** or see the parameter description on page A-10.	
6. Click on **Done**.	You return to the Configuration Manager window.

Preventing Data Loss for PPP and Frame Relay

Buffer size is the amount of memory allocated to store the transmission history. You must configure this parameter to protect against data loss if you run PPP or frame relay. You can use a buffer size of None, Normal, Large, or Very Large. The default value is Normal. Configure buffer size based on the following conditions:

- Length of time it takes for data to travel over the link

  A Normal buffer size is usually large enough for a coast-to-coast connection within the United States. You may need a Large or Very Large buffer if your link is over a satellite connection.

- Number of dropped packets

  For a link with a high number of dropped packets, increase the buffer size. For a link with a very low number of dropped packets, decrease the buffer size, even to None, to conserve memory.

- Number of resets

  For a link with a high number of resets and a low number of dropped packets, increase the buffer size. Be aware, however, that a high number of resets may occur for reasons unrelated to buffer size.

Note: X.25 is a reliable protocol, which means that it has features that check for errors and prevent data loss. Bay Networks data compression software ignores the Buffer Size parameter for X.25.

To modify the buffer size, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Lines**.	The WCP Line Interfaces List window opens.
4. Select a line from the list.	
5. Set the **Buffer Size** parameter. Click on **Help** or see the parameter description on page A-6.	
6. Click on **Done**.	You return to the Configuration Manager window.

Customizing Hardware Compression

The following issues are specific to hardware compression:

- Selecting software or hardware compression (described on page 3-9)
- Selecting a fallback compression mode (described on page 3-11)

Selecting Software or Hardware Compression

When you configure a VC for compression, the default compression type varies (Table 3-4).

Table 3-4. Default Compression Type Dependencies

Module Type	Default Compression Type
Link module that does not support hardware compression	Software
Link module that supports hardware compression	Hardware
Net module other than hardware compression net module	Software
Hardware compression net module	Hardware
Advanced compression coprocessor daughterboard	Hardware

You can use software compression with a hardware compression daughterboard or net module. Bay Networks recommends that you use hardware compression for connections operating at speeds greater than 512 Kb/s. You should specify software compression for VCs in excess of the number of contexts your hardware compression daughterboard or net module can support.

To specify hardware or software compression for a line configured with WCP, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Lines**.	The WCP Line Interfaces List window opens.
4. Select a line from the list.	
5. Set the **Engine Type** parameter. Click on **Help** or see the parameter description on page A-6.	
6. Click on **Done**.	You return to the Configuration Manager window.

To specify hardware or software compression for a circuit configured with WCP, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Interfaces**.	The WCP Circuit Interfaces List window opens.
4. Select a circuit from the list.	
5. Set the **Engine Type** parameter. Click on **Help** or see the parameter description on page A-11.	
6. Click on **Done**.	You return to the Configuration Manager window.

To specify hardware or software compression for an interface configured with Hi/fn LZS compression, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Hi/fn LZS**.	The Hi/fn LZS menu opens.
3. Choose **Interfaces**.	The Hi/fn LZS Interface List window opens.
4. Select an interface from the list.	
5. Set the **Engine Type** parameter. Click on **Help** or see the parameter description on page A-12.	
6. Click on **Done**.	You return to the Configuration Manager window.

Selecting a Fallback Compression Mode

The fallback compression mode is the compression mode that you want to use when no hardware compression contexts are available. You can set a fallback compression mode for a WCP line interface or for a Hi/fn LZS interface.

When configuring a WCP line interface, the options are as follows:

- Software CPC -- a good choice for lower-speed links, 64 Kb/s or less. It generally affords a better compression ratio than Hardware PPC.
- Hardware PPC -- a good choice for higher-speed links, greater than 64 Kb/s. It provides better throughput than Software CPC.
- None -- a good choice for very high-speed links.

When configuring a Hi/fn LZS circuit interface, the options are as follows:

- Software CPC -- a good choice for lower-speed links, 64 Kb/s or less.
- None -- a good choice for extremely high-speed links, greater than 2.5 Mb/s.

To modify the fallback compression mode for a line configured with WCP, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Lines**.	The WCP Line Interfaces List window opens.
4. Select a line from the list.	
5. Set the **Fallback Compression Mode** parameter. Click on **Help** or see the parameter description on page A-7.	
6. Click on **Done**.	You return to the Configuration Manager window.

To modify the fallback compression mode for a Hi/fn LZS interface, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Hi/fn LZS**.	The Hi/fn LZS menu opens.
3. Choose **Interfaces**.	The Hi/fn LZS Interface List window opens.
4. Select an interface from the list.	
5. Set the **Fallback Compression Mode** parameter. Click on **Help** or see the parameter description on page A-13.	
6. Click on **Done**.	You return to the Configuration Manager window.

Changing the Compression Control Protocol

The PPP interface parameters that you can modify for compression are CCP Type and Compression Protocol. These parameters enable the router to operate with Bay Networks routers using router software earlier than Version 12.10 and with non-Bay Networks routers.

Modifying the CCP Type parameter enables a router operating with BayRS Version 12.10 and later to be compatible with routers running previous versions of BayRS that negotiate WCP below the PPP multilink bundle. For more information about PPP multilink and how it works with WCP, see "PPP Multilink" on page 2-12.

Modifying the Compression Protocol parameter lets you specify a particular protocol to use or instructs the router to negotiate which protocol to use.

You can use Site Manager to modify PPP compression parameters. To change the compression control protocol, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **PPP**.	The PPP menu opens.
3. Choose **Interfaces**.	The PPP Interface Lists window opens.
4. Select an interface from the list.	
5. Set the **CCP Type** parameter. Click on **Help** or see the parameter description on page A-14.	
6. Set the **Compression Protocol** parameter. Click on **Help** or see the parameter description on page A-15.	
7. Click on **Done**.	You return to the Configuration Manager window.

Disabling and Reenabling Compression

You can disable compression on a line or circuit, then reenable it later.

Disabling and Reenabling WCP on a Line

To disable or reenable WCP on a line, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Lines**.	The WCP Line Interfaces List window opens.
4. Select a line from the list.	
5. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-3.	
6. Click on **Done**.	You return to the Configuration Manager window.

Disabling and Reenabling WCP on a Circuit

To disable or reenable WCP on a circuit, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Interfaces**.	The WCP Circuit Interfaces List window opens.
4. Select a circuit from the list.	

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
5. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-9.	
6. Click on **Done**.	You return to the Configuration Manager window.

Disabling Hi/fn LZS

To disable or reenable Hi/fn LZS on an interface, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Hi/fn LZS**.	The Hi/fn LZS menu opens.
3. Choose **Interfaces**.	The Hi/fn LZS Interface List window opens.
4. Select an interface from the list.	
5. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-12.	
6. Click on **Done**.	You return to the Configuration Manager window.

Deleting Data Compression from a Router

To delete compression from all circuits on the router, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols.**	The Protocols menu opens.
2. Choose **WCP** or **Hi/fn LZS.**	The WCP or Hi/fn LZS menu opens.
3. Choose **Delete WCP** or **Delete Hi/fn LZS.**	Site Manager prompts you to confirm the deletion.
4. Click on **OK.**	You return to the Configuration Manager window. Compression is no longer operating on the router.

Appendix A
Site Manager Parameters

This appendix contains the Site Manager parameter descriptions for data compression services. You can display the same information using Site Manager online Help. This appendix contains the following information:

Topic	Page
WCP Line Interface Parameters	A-2
WCP Circuit Interface Parameters	A-8
Hi/fn LZS Interface Parameters	A-11
PPP Interface Parameters for Compression	A-14

For each parameter, this appendix provides the following information:

- Parameter name
- Configuration Manager menu path
- Default setting
- Valid parameter options
- Parameter function
- Instructions for setting the parameter
- Management information base (MIB) object ID

The Technician Interface allows you to modify parameters by issuing **set** and **commit** commands with the MIB object ID. This process is equivalent to modifying parameters using Site Manager. For more information about using the Technician Interface to access the MIB, see *Using Technician Interface Software*.

Caution: The Technician Interface does not verify the validity of your parameter values. Entering an invalid value can corrupt your configuration.

WCP Line Interface Parameters

The WCP Line Interfaces List window (Figure A-1) contains all data compression line parameters.

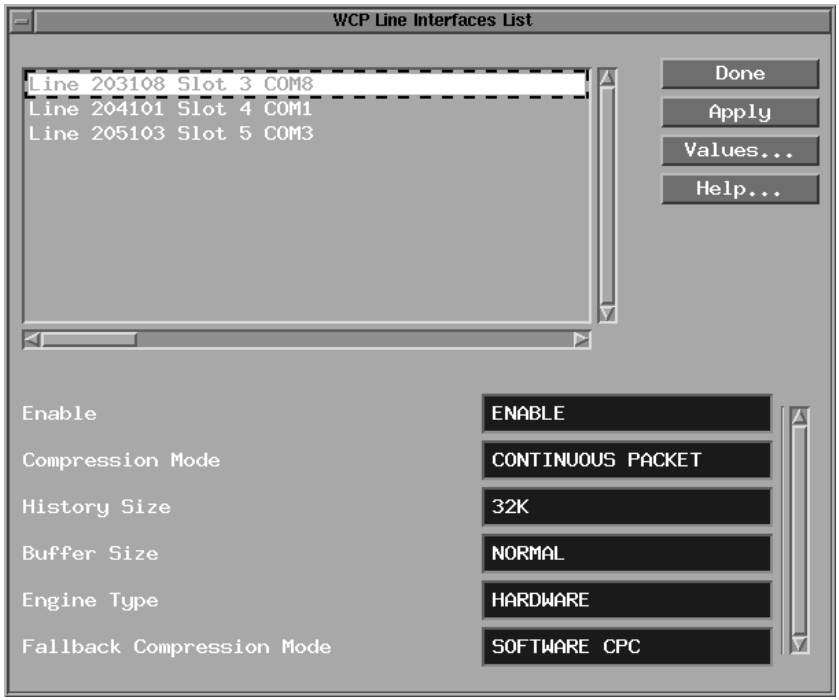


Figure A-1. WCP Line Interfaces List Window

To access the WCP Line Interfaces List window, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Lines**.	The WCP Line Interfaces List window opens.

The parameter descriptions follow.

Parameter: Enable

Path: Configuration Manager > Protocols > WCP > Lines

Default: Enable

Options: Enable │ Disable

Function: Enables or disables data compression on the line.

Instructions: WCP automatically sets this parameter to Enable when you select WCP in the Select Protocols window. If you want to temporarily disable WCP rather than delete it from the router, set this parameter to Disable. To reenable WCP, reset it to Enable.

MIB Object ID: 1.3.6.1.4.1.18.3.4.22.1.1.2

Parameter:	**Compression Mode**
Path:	Configuration Manager > Protocols > WCP > Lines
Default:	Continuous Packet
Options:	Continuous Packet | Packet by Packet
Function:	Specifies the compression mode on the line. Continuous packet compression (CPC) retains compression history across packets and allows a higher compression ratio than packet-by-packet compression. Packet-by-packet compression (PPC) resets compression history at the start of each packet, resulting in a lower compression ratio. Because PPC does not depend on previous packets, you should select this option for a link that drops a large number of packets.
Instructions:	Select either Continuous Packet or Packet by Packet.
MIB Object ID:	1.3.6.1.4.1.18.3.4.22.1.1.5

Parameter: History Size

Path: Configuration Manager > Protocols > WCP > Lines

Default: 32K

Options: 32K | 8K

Function: Specifies the amount of memory allocated to compression history for the line. Remember that history size has separate compression and decompression histories and lookup tables on each side of a link.

If the link uses software compression with a history of 8 KB, each end of the link allocates a total of 32 KB as follows:

- 8 KB for compression
- 16 KB for a lookup table
- 8 KB for decompression

If the link uses a compression history of 32 KB, each end of the link allocates a total of 128 KB as follows:

- 32 KB for compression
- 64 KB for a lookup table
- 32 KB for decompression

Hardware compression has similar requirements.

Selecting 32K for PPP WCP should not be a problem for the BN, because PPP allows only one circuit per line. Select 8K or 32K for frame relay and X.25 lines, depending on the resources of your network.

Selecting 32K for PPP WCP on the ASN can cause problems, particularly if you are using a 32-context compression net module.

In general, 8 KB histories are appropriate for WAN links that run at speeds of 64 Kb/s or less, because less throughput is required. Use an 8 KB history size with frame relay and X.25, which have large numbers of VCs and may have low available bandwidth, and with PPP on a 32-context net module.

You may want to allocate a 32 KB history size for links with speeds higher than 64 Kb/s to improve throughput. The compression engine can find a data pattern match up to three times faster using a 32 KB history.

If you select different history sizes for each side of a link, the smaller of the two becomes the effective history size.

Instructions: Select either 32K or 8K.

MIB Object ID: 1.3.6.1.4.1.18.3.4.22.1.1.6

Parameter: **Buffer Size**

Path: Configuration Manager > Protocols > WCP > Lines

Default: Normal

Options: Very Large │ Large │ Normal │ None

Function: Indicates the amount of buffer memory for the transmission history on a line. Because X.25 has features that check for errors and prevent data loss, data compression software ignores the Buffer Size parameter for X.25.

Instructions: Set this parameter according to the end-to-end round-trip length of a WCP connection:

Select Normal for most land-line, coast-to-coast connections.

Select Large or Very Large for connections at a great distance from each other, such as satellite connections.

Select None for links that drop a very small number of packets.

Increase the buffer size for a link with a large number of resets.

MIB Object ID: 1.3.6.1.4.1.18.3.4.22.1.1.7

Parameter: **Engine Type**

Path: Configuration Manager > Protocols > WCP > Lines

Default: Software (unless you configured either an octal synchronous link module with a hardware compression daughterboard or a FRE-2-060E processor module with an advanced compression coprocessor daughterboard for the BN, or a hardware compression net module for the ASN, in which case the default is Hardware)

Options: Software │ Hardware

Function: Specifies whether compression for this node will be software-based or hardware-based.

Instructions: Select Software to use software-based compression, or select Hardware to use hardware-based compression. You can use hardware compression with PPP and frame relay only. You can use software compression with PPP, frame relay, or X.25.

MIB Object ID: 1.3.6.1.4.1.18.3.4.22.1.1.8

Parameter:	**Fallback Compression Mode**
Path:	Configuration Manager > Protocols > WCP > Lines
Default:	Software CPC
Options:	Software CPC | Hardware PPC | None
Function:	For hardware compression only, specifies the compression mode that you want to use when no hardware compression contexts are available. Software CPC is a good choice for lower-speed links, 64 Kb/s or less. It generally affords a better compression ratio than Hardware PPC. Hardware PPC is a good choice for higher-speed links, greater than 64 Kb/s. It provides better throughput than Software CPC. None is a good choice for very high-speed links.
Instructions:	Select Software CPC, Hardware PPC, or None.
MIB Object ID:	1.3.6.1.4.1.18.3.4.22.1.1.10

WCP Circuit Interface Parameters

The WCP Circuit Interfaces List window (Figure A-2) contains the data compression circuit parameters.

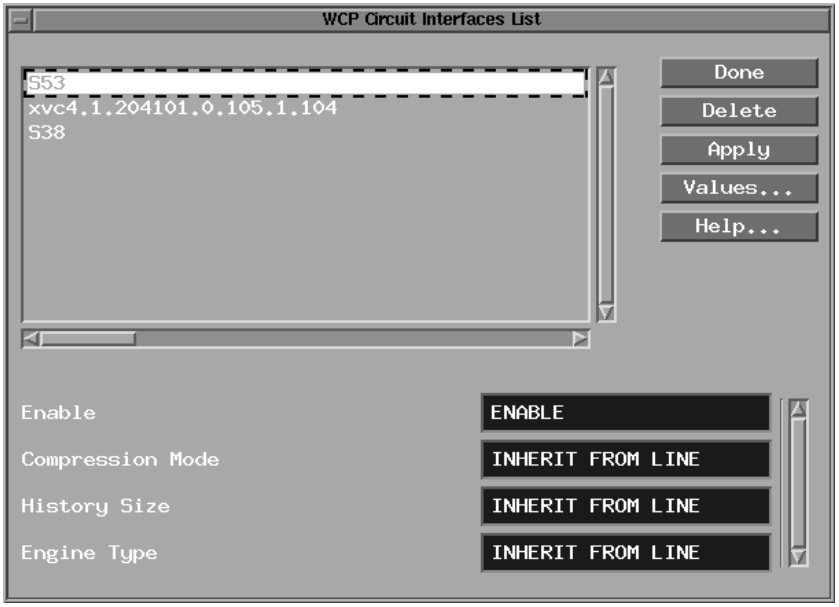


Figure A-2. WCP Circuit Interfaces List Window

To access the WCP Circuit Interfaces List window, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **WCP**.	The WCP menu opens.
3. Choose **Interfaces**.	The WCP Circuit Interfaces List window opens.

The parameter descriptions follow.

Parameter: Enable

Path: Configuration Manager > Protocols > WCP > Interfaces

Default: Enable

Options: Enable | Disable

Function: Enables or disables data compression on the circuit.

Instructions: WCP automatically sets this parameter to Enable when you select WCP in the Select Protocols window. If you want to temporarily disable WCP rather than delete it from the router, set this parameter to Disable. Reset it to Enable to reenable WCP.

MIB Object ID: 1.3.6.1.4.1.18.3.4.22.2.1.2

Parameter: Compression Mode

Path: Configuration Manager > Protocols > WCP > Interfaces

Default: Inherit from Line

Options: Continuous Packet | Packet by Packet | Inherit from Line

Function: Specifies the compression mode on the circuit.

Continuous packet compression (CPC) retains compression history across packets and allows a higher compression ratio than packet-by-packet compression (PPC).

Packet-by-packet compression (PPC) resets compression history at the start of each packet, resulting in a lower compression ratio. Because PPC does not depend on previous packets, you should select this option for a link that drops a large number of packets.

Inherit from Line allows you to set WCP parameters at the line level and apply them to circuits. For PPP, with only one circuit per line, this means that you can configure WCP at either the circuit level or the line level.

Instructions: Select Inherit from Line if you want to accept the value in effect for the WCP Compression Mode line parameter. Otherwise, select either Continuous Packet or Packet by Packet.

MIB Object ID: 1.3.6.1.4.1.18.3.4.22.2.1.4

Parameter: History Size

Path: Configuration Manager > Protocols > WCP > Interfaces

Default: Inherit from Line

Options: 32K │ 8K │ Inherit from Line

Function: Specifies the amount of memory allocated to compression history for the line. Remember that history size has separate compression and decompression histories and lookup tables on each side of a link. If the link uses a compression history of 8 KB, each end of the link allocates a total of 32 KB as follows:

- 8 KB for compression
- 16 KB for a lookup table
- 8 KB for decompression

If the link uses a compression history of 32 KB, each end of the link allocates a total of 128 KB as follows:

- 32 KB for compression
- 64 KB for a lookup table
- 32 KB for decompression

Hardware compression has similar requirements.

Selecting 32K for PPP WCP should not be a problem for the BN, because PPP allows only one circuit per line. Select 8K or 32K for frame relay and X.25 circuits, depending on the resources of your network. Selecting 32K for PPP WCP on the ASN can cause problems, particularly if you are using a 32-context compression net module.

In general, 8 KB histories are appropriate for WAN links that run at speeds of 64 Kb/s or less, because less throughput is required. Use an 8 KB history size with frame relay and X.25, which have large numbers of VCs and may have low available bandwidth, and with PPP on a 32-context net module. You may want to allocate a 32 KB history size for links with speeds higher than 64 Kb/s to improve throughput. The compression engine can find a data pattern match up to three times faster using a 32 KB history. If you select different history sizes for each side of a link, the smaller of the two becomes the effective history size.

Inherit from Line allows you to set WCP parameters at the line level and apply them to circuits.

Instructions: Select Inherit from Line if you want to accept the value in effect for the WCP History Size line parameter. Otherwise, select either 32K or 8K.

MIB Object ID: 1.3.6.1.4.1.18.3.4.22.2.1.5

Parameter:	**Engine Type**
Path:	Configuration Manager > Protocols > WCP > Interfaces
Default:	Inherit from Line
Options:	Software | Hardware | Inherit from Line
Function:	Specifies whether compression for this node will be software-based or hardware-based.
Instructions:	Select Inherit from Line if you want to accept the value in effect for the WCP Engine Type line parameter. Otherwise, select Software to use software-based compression or Hardware to use hardware-based compression. You can use hardware compression with PPP and frame relay only. You can use software compression with PPP, frame relay, or X.25.
MIB Object ID:	1.3.6.1.4.1.18.3.4.22.2.1.6

Hi/fn LZS Interface Parameters

The Hi/fn LZS Interface List window (Figure A-3) contains Hi/fn LZS interface parameters.

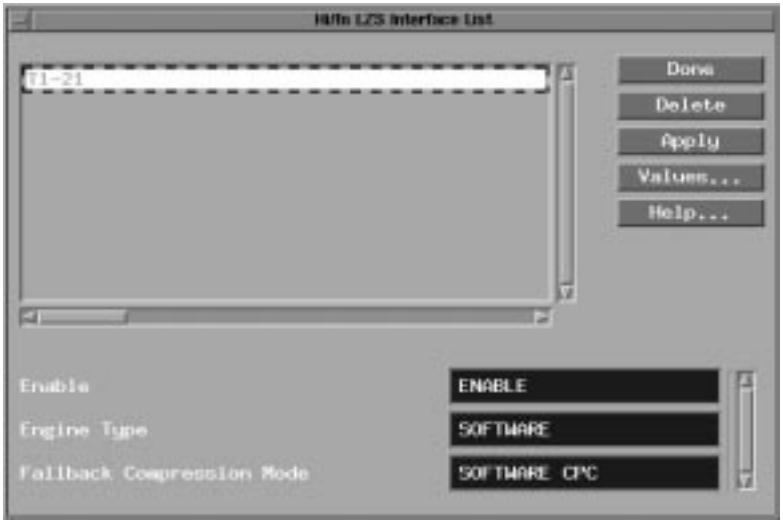


Figure A-3. Hi/fn LZS Interface List Window

To access the Hi/fn LZS Interface List window, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Hi/fn LZS**.	The Hi/fn LZS menu opens.
3. Choose **Interfaces**.	The Hi/fn LZS Interface List window opens.

The parameter descriptions follow.

Parameter: Enable

Path: Configuration Manager > Protocols > Hi/fn LZS > Interfaces

Default: Enable

Options: Enable | Disable

Function: Enables or disables Hi/fn LZS compression on this interface.

Instructions: Site Manager automatically sets this parameter to Enable when you select Hi/fn LZS as the compression protocol. If you want to temporarily disable Hi/fn LZS rather than delete it from the router, set this parameter to Disable. To reenable Hi/fn LZS, reset it to Enable.

MIB Object ID: 1.3.6.1.4.1.18.3.4.22.5.1.2

Parameter: Engine Type

Path: Configuration Manager > Protocols > Hi/fn LZS > Interfaces

Default: Software

Options: Software | Hardware

Function: Specifies whether data will be compressed by software or hardware.

Instructions: For hardware compression, set this parameter to Hardware.
For software compression, set this parameter to Software.

MIB Object ID: 1.3.6.1.4.1.18.3.4.22.5.1.4

Parameter:	**Fallback Compression Mode**
Path:	Configuration Manager > Protocols > Hi/fn LZS > Interfaces
Default:	Software CPC
Options:	Software CPC | None
Function:	When a circuit on this line cannot register for hardware compression due to a lack of hardware-context memory, this parameter determines whether data will be compressed by software or remain uncompressed.
Instructions:	If you want data to be compressed by software on a circuit that cannot register for hardware compression, set this parameter to Software CPC. If you want data to remain uncompressed on a circuit that cannot register for hardware compression, set this parameter to None. None is a good choice for very high-speed links.
MIB Object ID:	1.3.6.1.4.1.18.3.4.22.5.1.8

PPP Interface Parameters for Compression

The PPP Interface Lists window contains two parameters for data compression. (For more information about PPP, see *Configuring PPP Services*.)

To access the PPP Interface Lists window, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **PPP**.	The PPP menu opens.
3. Choose **Interfaces**.	The PPP Interface Lists window opens.

The PPP parameters for compression are as follows.

Parameter: CCP Type

Path: Configuration Manager > Protocols > PPP > Interfaces

Default: CCP

Options: ILCCP | CCP

Function: Specifies the compression control protocol that the router uses for this interface.

Instructions: Accept the default, CCP, if you select Hi/fn LZS as the compression protocol, or if you select WCP as the compression protocol and you set the PPP Mode parameter to multilink. Using CCP as the compression type means that the router negotiates compression above the multilink bundle.

Select ILCCP if you are configuring a new circuit and you set the PPP Mode parameter to multilink, and the remote router is using router software earlier than Version 12.10. Using ILCCP as the compression type means that the router negotiates compression below the multilink bundle.

If you have a router running BayRS Version 12.10 or later using an older configuration file, the routers negotiate WCP below the multilink bundle by default. You can change this to CCP for the routers at both ends of the link to negotiate WCP above the multilink bundle.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.2.2.1.71

Parameter: Compression Protocol

Path: Configuration Manager > Protocols > PPP > Interfaces

Default: Any

Options: Any | WCP | Hi/fn LZS

Function: Specifies the compression protocol that the router uses for this interface.

Instructions: Accept the default, Any, if you want the router to automatically select the compression protocol that is compatible with the remote router, as follows:

- If the remote router can use either WCP or Hi/fn LZS, the router selects WCP, for example, if both ends of the connection are Bay Networks routers.
- If the remote router does not use WCP, but uses Hi/fn LZS, the router selects Hi/fn LZS. Conversely, if the remote router does not use Hi/fn LZS, but uses WCP, the router selects WCP.
- If the remote router does not recognize either WCP or Hi/fn LZS, then CCP does not complete negotiations and the router will not compress data.

Select WCP as the compression protocol if the remote router is a Bay Networks router.

Select Hi/fn LZS as the compression protocol if the remote router is not a Bay Networks router.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.2.2.1.72

Appendix B
Show Commands for Hardware Compression

This appendix describes how to use the BCC **show** command to display information about software compression from the management information base (MIB). The type and amount of data displayed depends on the hardware compression settings you want to view.

Use the BCC show command to display status and statistical information about hardware compression.

This appendix includes descriptions of the following **show** commands:

Command	Page
show hwcomp all	B-2
show hwcomp state	B-3
show hwcomp stats	B-3
show hwcomp errors	B-5
show hwcomp chip	B-6
show wcp hwcomp all	B-7
show wcp hwcomp state	B-8
show wcp hwcomp stats	B-9
show wcp hwcomp errors	B-10
show hifn hwcomp all	B-11
show hifn hwcomp state	B-12
show hifn hwcomp stats	B-13
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show hwcomp all

The BCC **show hwcomp all** command displays information about active and unused contexts and statistics about compressed and decompressed packets. This command combines statistics for WCP and Hi/fn.

The output contains the following information:

Slot/<module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
State	Current operating state of the compression hardware.
Hardware Compression Module Type	Type of module.
Compression Module Chip Type	Type of chip.
Active Contexts	Number of active contexts by size and type.
Unused Contexts	Number of unused contexts by size and type.
Total Compressed Packets	Number of compressed packets.
Total Decompressed Packets	Number of decompressed packets.
Total Tx Expanded Packets	Number of expanded packets transmitted.
Total Rx NonCompressed Packets	Number of uncompressed packets received.
Total Compression Errors	Number of compression errors.
Total Decompression Errors	Number of decompression errors.
Total LCB Errors	Number of Longitudinal Check Byte (LCB) errors.

Total Tx NonCompressed Packets	Number of uncompressed packets transmitted.
Total Rx Dropped Packets	Number of dropped packets received.

show hwcomp state

The BCC **show hwcomp state** command displays the status of hardware compression at the instant the command is issued. This command combines statistics for WCP and Hi/fn.

The output contains the following information:

Slot/<Module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
State	Current operating state of the compression hardware.
Hardware Compression Mod Type	Type of module.
Active Contexts	Number of active contexts by size and type.
Unused Contexts	Number of unused contexts by size and type.

show hwcomp stats

The BCC **show hwcomp stats** command displays statistics about hardware compression at the instant the command is issued. This command combines statistics for WCP and Hi/fn.

The output contains the following information:

Slot/<Module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
Total Compressed Packets	Number of compressed packets.
Total DeCompressed Packets	Number of decompressed packets.
Total Tx Expanded Packets	Number of expanded packets transmitted.
Total Rx NonCompressed Packets	Number of uncompressed packets received.

show hwcomp errors

The BCC **show hwcomp errors** command displays information about hardware compression errors. This command combines statistics for WCP and Hi/fn.

The output contains the following information:

Slot/<Module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
Total Compression Errors	Number of compression errors.
Total Decompression Errors	Number of decompression errors.
Total LCB Errors	Number of Longitudinal Check Byte (LCB) errors.
Total Tx NonCompressed Packets	Number of uncompressed packets transmitted.
Total Rx Dropped Packets	Number of dropped packets received.

show hwcomp chip

The BCC **show hwcomp chip** command identifies the chip type that is performing hardware compression.

The output contains the following information:

Slot/<Module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
Chip Type	Type of chip performing hardware compression services.

show wcp hwcomp all

The BCC **show wcp hwcomp all** command displays information about active and unused contexts and statistics about compressed and decompressed packets.

The output contains the following information:

Slot/<module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
State	Current operating state of the compression hardware.
Hardware Compression Module Type	Type of module.
Compression Module Chip Type	Type of chip.
Active Contexts	Number of active contexts by size and type.
Unused Contexts	Number of unused contexts by size and type.
Total Compressed Packets	Number of compressed packets.
Total Decompressed Packets	Number of decompressed packets.
Total Tx Expanded Packets	Number of expanded packets transmitted.
Total Rx NonCompressed Packets	Number of uncompressed packets received.
Total Compression Errors	Number of compression errors.
Total Decompression Errors	Number of decompression errors.
Total LCB Errors	Number of Longitudinal Check Byte (LCB) errors.

Total Tx NonCompressed Packets	Number of uncompressed packets transmitted.
Total Rx Dropped Packets	Number of dropped packets received.

show wcp hwcomp state

The BCC **show wcp hwcomp state** command displays the status of hardware compression at the instant the command is issued.

The output contains the following information:

Slot/<Module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
State	Current operating state of the compression hardware.
Hardware Compression Mod Type	Type of module.
Active Contexts	Number of active contexts by size and type.
Unused Contexts	Number of unused contexts by size and type.

show wcp hwcomp stats

The BCC **show wcp hwcomp stats** command displays statistics about hardware compression at the instant the command is issued.

The output contains the following information:

Slot/<Module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
Total Compressed Packets	Number of compressed packets.
Total DeCompressed Packets	Number of decompressed packets.
Total Tx Expanded Packets	Number of expanded packets transmitted.
Total Rx NonCompressed Packets	Number of uncompressed packets received.

show wcp hwcomp errors

The BCC **show wcp hwcomp errors** command displays information about hardware compression errors.

The output contains the following information:

Slot/<Module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
Total Compression Errors	Number of compression errors.
Total Decompression Errors	Number of decompression errors.
Total LCB Errors	Number of Longitudinal Check Byte (LCB) errors.
Total Tx NonCompressed Packets	Number of uncompressed packets transmitted.
Total Rx Dropped Packets	Number of dropped packets received.

show hifn hwcomp all

The BCC **show hifn hwcomp all** command displays information about active and unused contexts and statistics about compressed and decompressed packets.

The output contains the following information:

Slot/<module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
State	Current operating state of the compression hardware.
Hardware Compression Module Type	Type of module.
Compression Module Chip Type	Type of chip.
Active Contexts	Number of active contexts by size and type.
Unused Contexts	Number of unused contexts by size and type.
Total Compressed Packets	Number of compressed packets.
Total Decompressed Packets	Number of decompressed packets.
Total Tx Expanded Packets	Number of expanded packets transmitted.
Total Rx NonCompressed Packets	Number of uncompressed packets received.
Total Compression Errors	Number of compression errors.
Total Decompression Errors	Number of decompression errors.

Total Tx NonCompressed Packets	Number of uncompressed packets transmitted.
Total Rx Dropped Packets	Number of dropped packets received.

show hifn hwcomp state

The BCC **show hifn hwcomp state** command displays the status of hardware compression at the instant the command is issued.

The output contains the following information:

Slot/<Module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
State	Current operating state of the compression hardware.
Hardware Compression Mod Type	Type of module.
Active Contexts	Number of active contexts by size and type.
Unused Contexts	Number of unused contexts by size and type.

show hifn hwcomp stats

The BCC **show hifn hwcomp stats** command displays statistics about hardware compression at the instant the command is issued.

The output contains the following information:

Slot/<Module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
Total Compressed Packets	Number of compressed packets.
Total DeCompressed Packets	Number of decompressed packets.
Total Tx Expanded Packets	Number of expanded packets transmitted.
Total Rx NonCompressed Packets	Number of uncompressed packets received.

show hifn hwcomp errors

The BCC **show hifn hwcomp errors** command displays information about hardware compression errors.

The output contains the following information:

Slot/<Module>	For BN routers either: • The slot and module number of the FRE-2-060E with Advanced Compression Coprocessor daughterboard • The slot and module number of the FRE-2 with Octal Sync module (with hardware compression daughterboard) For ASN routers, the slot and module number of the hardware compression module.
Total Compression Errors	Number of compression errors.
Total Decompression Errors	Number of decompression errors.
Total Tx NonCompressed Packets	Number of uncompressed packets transmitted.
Total Rx Dropped Packets	Number of dropped packets received.

show hardware daughter_card

The BCC **show hardware daughter_card** command displays information about hardware that is performing compression services.

The output contains the following information:

Slot	Number of the slot in which the FRE-2-060E with Advanced Compression Coprocessor daughterboard is located.
Card Type	Type of compression hardware.
Revision	Version of the advanced compression coprocessor daughterboard.
Serial No.	Identification number assigned to the advanced compression coprocessor daughterboard.

Appendix C
Monitoring Software Compression Using the BCC show Commands

This appendix describes how to use the BCC **show** command to display information about software compression from the management information base (MIB). The type and amount of data displayed depends on the software compression settings you want to view.

This appendix includes descriptions of the following **show** commands:

Command	Page
show wcp lines	C-2
show wcp circuits	C-2
show wcp vcs	C-3
show wcp stats all	C-4
show wcp stats error1	C-4
show wcp stats error2	C-5
show hifn circuits	C-6
show hifn stats	C-6
show hifn stats error	C-7

show wcp lines

The **show wcp lines** command displays information about WCP compression configured for lines on the router.

The output includes the following information:

Channel Number	Number of the channel on which WCP compression is configured.
Slot/<Mod>/ Connector	The line identified by slot number, module type, and connector number.
State	State of WCP compression on the line: Enabled or Disabled.
Compression Mode	The compression mode operating on the line: continuous packet compression (CPC), packet-by-packet compression (PPC), or the mode inherited from the line.
History Size	The amount of memory allocated to compression history for the line.
Buffer Size	The amount of buffer memory for transmission history on the line
Configured Engine Type	The type of compression operating on the line: hardware or software.

show wcp circuits

The **show wcp circuits** command displays information about WCP compression operating on the circuit.

The output includes the following information:

Circuit Name	Circuit name of the interface.
State	State of WCP compression on the circuit: Enabled or Disabled.
Compression Mode	The compression mode operating on the line: continuous packet compression (CPC) or packet-by-packet compression (PPC).
History Size	The amount of memory allocated to compression history for the circuit.
Configured Engine Type	The type of compression operating on the circuit: hardware or software.

show wcp vcs

The **show wcp vcs** command displays information about virtual circuits running WCP compression.

The output includes the following information:

Slot/<Mod>/ Connector	Interface identified by slot, module, and connector.
Channel Number	Number of the channel on which this virtual circuit is running.
Circuit Name	Circuit name of the interface.
Vc Id	Identification of the virtual circuit.
Compression State	State of the compression software on the virtual circuit: • data (data is being compressed) • disabled (compression software is inoperative) • disconnected (compression is not connected to the virtual circuit) • init (compression software is initializing) • nak (compression software is returning a negative acknowledgment)
Decompression State	State of the decompressing software on the virtual circuit: • data (data is being decompressed) • disabled (decompression software is inoperative) • disconnected (decompression is not connected to the virtual circuit) • init (decompression software is initializing) • rexmit (decompression software is retransmitting) • reset (decompression software has been reset) • connecting (decompression software is connecting to the virtual circuit) • disconnecting (decompression software is disconnecting from the virtual circuit)
Actual Comp Mode	Compression mode operating on the circuit: continuous packet compression (CPC) or packet-by-packet compression (PPC).
Actual Hist Size	Amount of memory allocated to compression history for the circuit.
Actual Engine Type	Type of compression operating on the circuit: hardware or software.

show wcp stats all

The **show wcp stats all** command displays statistical information about the performance of WCP compression on the circuit.

The output includes the following information:

Slot/<Mod>/ Connector	The interface identified by slot, module, and connector.
Channel Number	The number of the channel on which this virtual circuit is running.
Circuit Name	Circuit name of the interface.
Vc Id	Identification of the virtual circuit.
Compression Ratio	Ratio of number of bytes received by the WCP compression software to the number of bytes transmitted by it.
Decompression Ratio	Ratio of number of bytes received by the WCP decompression software to the number of bytes transmitted by it.
Compressor In	Number of packets received by the compressor.
Compressor Out	Number of packets transmitted from the compressor.
Decompressor In	Number of packets received by the decompressor.
Decompressor Out	Number of packets transmitted from the decompressor.
CPC pkts	Number of CPC packets transmitted (Tx) and received (Rx).
PPC pkts	Number of PPC packets transmitted (Tx) and received (Rx)..

show wcp stats error1

The **show wcp stats error1** command displays information about error conditions for WCP compression on the connection.

The output includes the following information:

Channel Number	The number of the channel on which this virtual circuit is running.
Circuit Name	Circuit name of the interface.
Vc Id	Identification of the virtual circuit.
Anti-Expanded Packets (Tx)	Number of anti-expanded packets transmitted.
Anti-Expanded Packets (Rx)	Number of anti-expanded packets received.

Data Out of Sequence	Number of instances registered of the data-out-of-sequence condition.
Rexmit Out of Sequence	Number of times that an acknowledgment was retransmitted out of sequence.
Rexmit Time-Outs	Number of timeout messages retransmitted.
Exceeded Ks	Number of times that K was exceeded. (WCP maintains a transmit history of data packets for a specified range called “K.” A packet can be retransmitted if it remains in the range of packets kept in the transmit history. If a packet is outside the range specified by K, it cannot be retransmitted.

show wcp stats error2

The **show wcp stats error2** command displays information about error conditions pertaining to WCP compression on the connection.

The output includes the following information:

Channel Number	The number of the channel on which this virtual circuit is running.
Circuit Name	Circuit name of the interface.
Vc Id	Identification of the virtual circuit.
Reset Packets (Tx)	Number of reset packets transmitted.
Reset Packets (Rx)	Number of reset packets received.
Re-transmit Request (Tx)	Number of retransmit request packets transmitted.
Re-transmit Request (Rx)	Number of retransmit request packets received.
Re-transmit Naks (Tx)	Number of negative acknowledgments transmitted
Re-transmit Naks (Rx)	Number of negative acknowledgments received

show hifn circuits

The **show hifn circuits** command displays information about circuits configured to operate Hi/fn compression.

The output includes the following information:

Circuit Name	Circuit name of the interface.
State	State of Hi/fn compression on the circuit: Enabled or Disabled.
Configured Engine Type	The type of compression operating on the circuit: hardware or software.

show hifn stats

The **show hifn stats** command displays statistical information about the performance of Hi/Fn compression on the circuit.

The output includes the following information:

Circuit Name	Circuit name of the interface.
Compression Ratio	Ratio of number of bytes received by the Hi/fn compression software to the number of bytes transmitted by it.
Decompression Ratio	Ratio of number of bytes received by the Hi/fn decompression software to the number of bytes transmitted by it.
Compressor In	Number of packets received by the compressor.
Compressor Out	Number of packets transmitted from the compressor.
Decompressor In	Number of packets received by the decompressor.
Decompressor Out	Number of packets transmitted from the decompressor.
CPC Packets (Tx)	Number of CPC packets transmitted.
CPC Packets (Rx)	Number of CPC packets received.

show hifn stats error

The **show hifn stats error** command displays information about error conditions for Hi/fn compression on the connection.

The output includes the following information:

Circuit Name	Circuit name of the interface.
Expanded Pkts (Tx)	Number of expanded packets transmitted.
Expanded Pkts (Rx)	Number of expanded packets received.
Reset Requests (Tx)	Number of reset requests transmitted.
Reset Requests (Rx)	Number of reset requests received.

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